REMARKS

Claims 34-36 have been canceled and new claims 37-40 have been added. No new matter was added. Accordingly, claims 2, 3, 14, 20 and 37-40 are pending. Clams 15-19 and 21-25 are withdrawn as being directed to a non-elected species but remain in the application in the event that they can be re-joined. Applicants submit claim amendments, arguments and a Declaration of one of the named inventors under 37 CFR §1.132 for overcoming the rejections based on the prior art of record and respectfully submit that the present application is in condition for allowance.

Claim Rejections - 35 USC §103(a)

> *In the FINAL Office Action dated April 9, 2008, claims 2, 3, 14, 20 and 34-36 are rejected under 35 USC §103(a) as being obvious over the publication of Fan et al. titled "Deformation behavior of Zr-based bulk nanocrystalline amorphous alloys" in view of U.S. Patent No. 6,096,640 of Hu.*

Fan et al.

Fan et al. disclose a method of making an ingot by "arc melting the mixtures of pure metals in a purified argon atmosphere and cast into a copper mould in vacuum." (See the sentence bridging columns 1 and 2 on page R3761 of the Fan et al. publication.) This method relies on the use of a copper mold to perform arc melting and quenching. Such a method is disclosed as "conventional" on page 1, line 30, to page 2, line 3, of the present application, as filed. The present application also discusses the disadvantages of such a method, namely, that it "incurs high costs" and that "the manufacturable shape is also limited". (See page 2, lines 10-15, of the present application, as filed.)

Fan et al. manufactures and discloses an ingot or specimen that is of a very small size relative to the size of a typical sputtering target. The specimen of Fan et al. is 2mm in diameter and 4.5 mm long. (See column 2, lines 16-17, of page R3761 of the Fan et al. publication.)

Hu

On column 5, line 60, to column 6, line 2, Hu discloses a tungsten silicide (W-Si) sputtering target in an amorphous phase for depositing a tungsten silicide nitride diffusion barrier.

Claim Amendment to Independent Claim 2 of the Present Application

Applicants have amended independent claim 2 to include the limitations formerly stated in dependent claims 34-36. No new matter was added. Accordingly, claim 2 requires the sputtering target to have a diameter of 100mm or more and the average crystallite size of 1nm to 5nm to be uniform entirely throughout the sputtering target.

Stated Reasons for Rejection

With respect to the rejection of claims 35 and 36, the FINAL Office Action states:

> "... it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the bulk metallic glass produced in the process of Fan et al. in view of Hu ('640) into a sputtering target having the claimed diameter ***with expected success***, because Fan et al. in view of Hu ('640) disclose that the bulk metallic glass having throughout uniform average crystallite size of 2.0-2.5 nm (Fan et al., the paragraph bridging the left and right columns and FIG. 2, page R3762), which reasonably appear to be only slightly different than the bulk metallic glass as claimed in the instant claim 2, ***can be successfully produced without any limitations on the size and the shape*** of the bulk metallic glass to be produced (abstract)."

The FINAL Office Action also includes the following generalized statement:

"... it is well settled that merely changing the size of an article is not a matter of invention."

Further, the FINAL Office Action states:

"... arguments of the counsel cannot be relied upon as evidence."

Applicants Arguments for Non-Obviousness

In response to the above referenced rejection and statements, Applicants respectfully request that Applicants' arguments submitted in the previously-filed Amendment be reconsidered in view of the Declaration of Akihisa Inoue, filed herewith, and the following additional comments.

First, Applicants do not dispute that, as a general statement, merely changing the size of an article may not be a matter of invention assuming that the size can be readily changed by one of ordinary skill in the art. However, Applicants respectfully submit that this general statement does not apply to the specific facts at hand. One of skill in the art following the teachings of Fan et al. would not be able to produce the sputtering target required by independent claim 2, as amended, from the disclosure of the 2mm in diameter specimen of Fan et al. for any of the reasons stated in the Declaration of Akihisa Inoue. Here, known technology does not permit one of ordinary skill in the art to simply increase the size of the specimen and maintain its characteristics and uniformity.

For example, as stated in section 4 of the Declaration, a sufficiently large amount of Zr-based nanocrystalline amorphous alloy to produce a sputtering target of 100mm is about 324g and such a large amount cannot be cooled evenly. The cooling rate will be affected by the coefficient of thermal conductivity of the metal and the length of the path of thermal

conductance. When the amount of metal is increased, the length of the heat transfer path in the metal will also increase, and the longer the length of heat transfer path becomes, the greater the thermal resistance will become. Accordingly, as stated by the Declaration of Akihisa Inoue, the required "increase in the amount of metal will become a cause of not being able to manufacture uniform metallic glass."

Thus, it is respectfully submitted that the material produced according to Fan et al. at a size of 2mm in diameter and 4.5 mm long cannot simply be made to a larger size and still have the same characteristics as that of the small specimen. Independent claim 2 of the present invention not only requires a sputtering target having a diameter of 100mm or more, but also requires the average crystallite size of 1nm to 5nm to be uniform entirely throughout the sputtering target. One of ordinary skill in the art at the time of the invention cannot produce the specimen of Fan et al. having a diameter of 100mm or greater, and even if they could, it would not possess the characteristic of having a uniform 2.0 to 2.5nm average crystallite size due to the inherent uneven cooling that would be experienced during quenching. See the Declaration of Akihisa Inoue.

Also, from Applicants' previously-filed Amendment, when manufacturing bulk metal glass by quenching molten metal, the cooling speed of the surface of the material forming the ingot that contacts the mold will differ greatly from the cooling speed of material that is embedded deep within the interior of the ingot spaced from the mold. Accordingly, crystallite size of surface areas of the formed bulk metal glass ingot will differ greatly from that of areas centered deep within the bulk metal glass ingot. Such a specimen would not meet the uniformity limitations required by claim 2 of the present application.

In contrast, when sintering gas atomized powder as required by the present invention, there is no temperature difference at outer and inner areas of the sputtering target and crystallite size is uniform throughout the target.

Further, cooling speed of the sintered gas atomized powder target of the present invention is fast at 10^3K/sec. In comparison, cooling speed of the cast ingot of Fan et al. is relatively slow at 10^{-3} to 10^1K/sec. Consequently, with respect to the present invention, it is possible to manufacture a relatively large bulk sintered compact suitable for use as a sputtering target in which the crystal structure of the target is ultrafine and uniform. The same cannot be said for the arc melting and quenching method of Fan et al. which can only form ultrafine and uniform structures of very limited size. If the size of the specimen of Fan et al. is increased to a sputtering target size having a diameter of 100mm or more, it would not have an ultrafine or uniform crystal structure as required by claim 2 of the present application.

For at least these reasons, Applicants respectfully submit that claim 2 and the present application is not obviated by Fan et al. in view of Hu. Hu fails to overcome any of the deficiencies discussed above with respect the Fan et al. publication. Hu merely discloses a tungsten silicide target having a vastly different composition relative to that required by Fan et al. and the claims of the present application.

The present invention provides an advance in the art of metallic glass sputtering targets that is not disclosed, suggested, taught or contemplated by Fan et al. and Hu. One of ordinary skill in the art is not taught by Fan et al. in view of Hu a sputtering target required by claim 2 or even that it is possible to make such a target. Applicants respectfully submit that the invention of claim 2 of the present application is meritorious and worthy of a patent.

New Claims 37-40

New independent claim 37 includes all the limitations stated in claims 2, 14 and 20. Thus, no new matter was added. It is clearly limited to a metallic glass sputtering target made of an alloy in which Zr is the primary component and in which at least one of Cu, Ni and Al is included. The subject matter of claim 38 is disclosed by claim 3. The subject matter of claims 39 and 40 is disclosed in the present application, as filed, on page 6, lines 8-9.

Conclusion

In view of the above amendments, remarks and Declaration of Akihisa Inoue, Applicants respectfully submit that the rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

Respectfully submitted,
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